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ABSTRACT

This description of ways in which a microcomputer can enhance the process of conducting qualitative research uses a multiple site case study in education carried out during 1986-87 as an example (the study examined the mobilization and implementation stages of introducing microcomputers into a majority adopter school district). Specific microcomputer applications are described, i.e., the use of 512K Macintosh computer to facilitate the collection, analysis, and presentation of ethnographic interviews, naturalistic observations, historical documents, and tabular data. Software packages discussed in this context include MacWrite for word processing; FileMaker for creating databases; Multiplan to produce spreadsheets of tabular information; and MacDraw to produce graphs and illustrations for the final research project. Sample output is shown. Also discussed are the potentials of Hypercard, a new software package implementing the concept of hypertext that will enable researchers to organize qualitative data in a relational database. It is concluded that the computer proved especially valuable for tracking themes and for text arrangement, and that it allowed the researcher to collect, analyze, and present the data more efficiently. (21 references) (Author/MES)

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Use of a Microcomputer to Facilitate the Collection, Analysis and Presentation of Ethnographic Data

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Abstract

This paper describes how the use of a microcomputer can enhance the process of conducting qualitative research. A multiple site case study in education carried out during 1986-87 will be used as an example. The paper focuses upon the practical aspects of collecting, managing, and analyzing large amounts of data within the qualitative research paradigm.

The use of a 512-K Macintosh computer to facilitate the collection, analysis and presentation of ethnographic interviews, naturalistic observations, historical documents, and tabular data is described. Four standard software packages were used over the course of a year to record and manage a large volume of ethnographic data. They included MacWrite© for wordprocessing, FileMaker© for the creation of data bases, MultiPlan© to produce spreadsheets of tabular information, and MacDraw© to produce graphs and illustrations for the final research product.

The use of a microcomputer to process a large volume of ethnographic data allowed the researcher to perform the data collection, analysis and presentation more efficiently. The availability of a number of standard software packages allowed the researcher to facilitate the entire research process without having to depend upon staff computer programmers for a special package. The user-friendly, icon-based computing environment of the Macintosh microcomputer allows the user to move easily between different sofware applications and make it particularly well-suited for social scientists. A new software package called HyperCard© that will enable qualitative data to be organized in a relational data base is also discussed.

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Background

One of the most problematic characterisics of qualitative research is the large volume of data associated with any research project. If the researcher is not meticulous in keeping up with recording and coding the data for future analysis, it is possible to be overwhelmed by the sheer volume or to lose track of important cultural themes in the data. Most qualitative researchers have already discovered the joys of wordprocessing for recording, managing, and making copies of data and research findings. In this paper the usefulness of several other software tools readily available on most microcomputers are also discussed. A Macintosh 512-K memory computer was used to facilitate an ethnographic case study of the implementation of microcomputers for instruction in a school district completed during 1986-87.

In this study the mobilization and implementation stages of introducing microcomputers into a majority adopter school district were examined (Martin, 1987). The research was conducted as a multiple-site case study (Bass, 1978; Stake, 1978) using structured and unstructured interviews (Spradley, 1979; Becker & Geer, 1957) naturalistic observations (Spradley, 1980; Becker & Geer, 1957), content analysis of historical documents, computer usage statistics, and stages-of-concerns data (Hall, George & Rutherford, 1979). Interaction within the institutional context (Berman & McLaughlin, 1974), characteristics of the innovation (Rogers, 1985), and concerns of individuals (Hall, George & Rutherford, 1979) were examined within the loosely coupled operational units of a school district (Weick,1976): the central office, schools, and classrooms.

The use of ethnographic data collection techniques (Feinberg, 1977) produced a rich reservoir of information in which several conflicting themes were found. The data revealed resistance to innovation, strong grassroots support for microcomputers, fear of microcomputers, high motivation to use microcomputers, the influence of early adopter school districts, and the importance of the individual in the implementaton process. Characteristics of the implementation process that contributed to and detracted from institutionalization of microcomputers by the school district in the study also emerged from the data.

Data Collection

Data was collected by the researcher from structured and unstructured interviews and naturalistic observation in classrooms with pen and notebook. A labtop computer was not used because the researcher felt that the clicking of the keys would be an obtrusive distraction in the classroom environment. A tape recorder was used for a few visits, but also abandoned for being too obrusive to the enviroment. Instead the researcher recorded the information in a

notebook and then used the MacWrite© wordprocessing software available on the Macintosh computer to create a text file of each set of fieldnotes in the format shown in Figure 1.

Heading with identifying data:

Field Notes: **Date:** **Location:** **Page:**
Setting: **Person(s):**
Source:

Body of field notes:

1.		
2.		
3.		
4.		
5.	fieldnotes typed in with each	handwritten
6.		
7.	line numbered for reference	comments and
8.		
9.		annotations
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Figure 1. Format of typed fieldnotes in computer text files.

Structured interviews: There were data from nine structured interviews, six with school district staff personnel and three with the principals of the participating schools, to obtain their perspectives on the innovation, the decision-making process to adopt the innovation and the implementation process. For each structured interview the researcher scheduled an hour-long appointment with the staff person in advance, stating that the purpose of the interview. The researcher arrived with a set of broad questions that varied according to the staff position of the respondent. The questions were general enough to allow the respondent to address themes and events regarded to be important by the respondent. The questions were asked in a conversational manner by the researcher, and the answers were recorded by the researcher with pen and paper in a narrative fashion. The researcher recorded the answers in the respondent's own words. The interviews were then typed by the researcher into field notes within 48 hours after recording them.

Unstructured interviews: Fifty-three unstructured interviews were documented by the researcher. Unstructured interviews were different from the structured interviews in that the respondents did not know ahead of time that they were going to be interviewed. The purpose of the unstructured interviews conducted with three principals, three school librarians, and twenty-seven teachers was to answer specific questions about how the microcomputers were being used for instruction in a school or in a particular classroom.

Unstructured interviews lasted from 5 to 50 minutes each, depending upon the nature of the question(s) and the amount of time that the respondent had available for the interview. An unstructured interview was conducted with every teacher observed, with the librarians of each school, with a planner from the county planning officeand with an official of the U.S. Department of Education. The responses to unstructured interviews were recorded by the researcher in a narrative fashion at the time of the interview using pen and paper. The interviews were then typed by the researcher into field notes within 48 hours after recording them.

Naturalistic observations: Fifty-three naturalistic observations were conducted by the researcher in regular classrooms or the computer labs of the schools in the study. The purpose of the naturalistic observations was to determine how the teachers and students were using the microcomputers in the classrooms of the school district by documenting the kinds of interaction observed between teachers, students and computers.

The researcher went to the school district two days a week and stopped in at one or two of the three schools each day. The researcher based the observation schedule upon the microcomputer activities that were going on at each school. Overall, the researcher spent 12 to 16 hours of observation in each school and observed each kind of instructional use of the microcomputer at least once. Each observation lasted from 30 minutes to two hours for a total

of 45.5 hours of naturalistic observation. The length of an observation depended upon the activities going on in the classroom being observed and the researcher's own schedule. As long as one or more microcomputers were being used by one or more students, the researcher remained to record the activity.

When the observation took place in a regular classroom, the researcher documented the other activity, if any, that was occuring in the room while the computer was being used. During an observation the researcher sat beside a microcomputer and documented the activity that occurred as the child or children used the microcomputer. In the cases where there was more than one microcomputer in a classroom, the researcher sat by each of the computers for a complete session with a child or children. (In most cases the children would be at a computer for some amount of time specified by the teacher.)

In the lab observations, the researcher first sat in the middle of the room to record the general activity and then walked around the room to record individual activity at the computer. The researcher documented the overall atmosphere of the lab and the teacher's role in managing the lab situation. For both the lab and classroom setting the research notes were taken in longhand with a pen on a shorthand pad in a narrative style.

In both the lab and classroom setting the researcher noted the type of software being used on the computer, the teacher's role, if any, in assisting the children to use the software, the children's reaction to the software and the computer, the result of the interaction with the computer, and the interaction between the children in the room while using the computer. In addition, the researcher noted any reaction on the part of the children or the teacher to the presence of the researcher and the teacher's attitude toward having the students use the computer. The researcher typed up the field notes in a narrative format within 48 hours from the time the observation took place. When typing the field notes, the researcher added other details about the observation that were fresh in her mind.

Content analysis of historical documents: The historical documents included school board minutes, district planning reports, reports produced by school staff, demographic data and curriculum and course materials. They were examined for policy statements, goals, plans, budget allocations and concerns related to microcomputers.

Computer usage statistics: These were compiled by the researcher from the librarians' sign-out logs for the software and hardware. They were used to establish patterns and levels of use of the microcomputers.

Stages-of-concern data: These data were gathered from the participants of county-contracted, graduate level computer education courses directed and taught by the researcher. The Stages-of-Concern Questionnaire (SoCQ©) was used to measure the stages of concern felt by an individual toward an innovation using the stages-of-concern taxonomy:

awareness, informational, personal, management, consequence, collaboration, and refocusing (Hall, George, & Rutherford 1979). In this study the SoCQ© was used to measure the levels of concern felt by adminstrators and teachers toward microcomputers.

Data Analysis

Two major theoretical frameworks were found in the research literature about the implementation of an innovation in an educational setting. The first was related to the organizational structure of a school district into three autonomous operational levels (Weick,1976). The second was related to the major factors to be considered when studying the implementation process (Berman & McLaughlin, 1974, 1976, 1977, 1978; Hall, George & Rutherford, 1979; Rogers, 1983, 1985) This study was designed to put the two theoretical frameworks together to allow data analysis within a three by three matrix. The six types of data used to inform the components of the data analysis matrix are shown in Figure 2.

Data type:

1. Structured Interviews
2. Unstructured Interviews
3. Naturalistic Observations
4. Historical Documents
5. Computer Usage Statistics
6. Stages-of-Concern (SocQ©) Data

	Operational unit:		
Factor:	*school district*	*school*	*classroom*
institutional structure	1, 4	1, 2, 4	2, 3, 5
innovation characteristics	1, 4	1, 2, 4, 5	2, 3, 5
individual concerns	1, 4	1, 2, 3, 6	2, 3, 6

Figure 2. Data analysis matrix with related data.

Several conflicting cultural themes began to emerge from the data as the data collection progressed. As the volume of data began to grow and as the cultural themes emerged, the researcher also coded the fieldnotes into a computerized data base using a software package called FileMaker©. This enabled the researcher to find occurrences of common themes and to determine the distribution of the ethnographic data (Gillespie, 1982). A record was established in the data base for each unstructured interview or naturalistic observation with staff members or children. Throughout the data collection new fields could be added to the file to accomodate new themes in the data. The final format of the file is shown below:

1) **fn:** identification number of source field notes;

2) **site:** site of the interview or observation;

3) **date:** date of the interview or observation;

4) **name:** name of person(s) interviewed or observed;

5) **title:** title of person(s) interviewed or observed;

6) **concerns:** concerns of person(s) interviewed or observed;

7) **use:** use of the microcomputer classified by CAI (computer-assisted instruction), data base use, word-processing, simulations, LOGO programming, computer literacy instruction or other;

8) **intervene:** intervention by researcher and what kind;

9) **type of data:** unstructured interview or observation;

10) **time:** duration of the interview or observation;

11) **attitudes:** toward the microcomputer of interviewed or observed person(s).

At the end of the data collection there were over two hundred pages of field notes from the ethnographic interviews and observations (Lebar, 1970). Ninety-eight records were created from the fieldnotes for the data base. There were data from 138 stages-of-concern questionnaires (SoCQ) and four sets of computer usage figures. There were a dozen historical documents. With the creation of the data base, a profile of the ethnographic data was developed by doing searching and sorting based upon the various fields. The distribution of data by type and site was determined. These data were collected in the central office and three schools, identified by the pseudonyms:

a) District - the central office staff

b) Longfellow Middle School - the middle school

c) Crestwood Elementary School - the smaller elementary school

d) Fairview Elementary School - the larger elementary school

The distribution of data collected by source, site and kind of contact was calculated using the computerized data base to produce the table shown in Figure 3.

location:	*structured:*	*unstructured:*	*observation:*	*total:*
District	6	1	0	7
Longfellow	1	19	16	36
Crestwood	1	15	15	31
Fairview	1	18	22	41
	9	53	53	115

kind of contact:
teachers: 45 students: 53 principals: 6 librarians: 4

Figure 3. Distribution of ethnographic data.

Within each site, data were collected from the staff shown in Figure 4.

	number of interactions:
District:	
assistant superintendent of instruction	1
director of planning	1
supervisor of instructional services **	2
supervisior of special education **	1
director of vocational education	1
supervisor of home economics **	1
School 1: Longfellow Middle School	
principal: Mr. Jones **	1
librarian **	2
teachers:	
Mrs. Burton (Home Economics) *, **	**6**
Mrs. Riseling (Math) **	1
Mrs. Lee (LD)	2
Mrs. White (English) **	1
Mrs. Todd (Remedial Reading) **	1
in school restriction teacher	2
Miss. Lincoln (Language Arts) **	3
Mrs. Gray (Music) **	2
8th grade math teacher **	1
School 2: Crestwood Elementary School	
principal: Mr. Smith	3
librarian	2
teachers	
Mrs. Johnson (Chapt.I) *, **	**5**
Mrs. Jackson (lst) **	2
Mrs. Black (3rd)	1
Mrs. O'Connell (4th)	1
Mrs. Gordon (5th)	2
physical education teacher	1
School 3: Fairview Elementary School	
principal: Mrs. Engle	2
librarian **	2
teachers:	
Mrs. Merlin (K) **	2
Miss Lang (lst)	1
Mr. Wilson (lst)	1
Mrs. Harrison (2nd)	1
Mrs. James (2nd)	1
Mrs. Hogan (2nd) **	1
Mrs. Green (3rd) **	1
Mrs. Washington (4th) *, **	**5**
Mrs. John (4th)	1
Mrs. Emory (5th) **	3
Mr. Watson (5th)	2
speech therapist **	1

*** key informant**

** participated in a computer course

Figure 4. Staff involved in the data collection (with pseudonyms used).

One question of great interest to the researcher was to examine how the microcomputers were actually being used in the classroom with children. The data base was used to pull out the different stated and observed uses of the microcomputer. Since each record in the data base was coded with the number of the related fieldnotes, the researcher could easily move back and forth between data base records and the detailed fieldnotes. The frequency with which the different uses of the microcomputers were stated or observed are shown in Figure 5.

use:	*stated:*	*observed:*
CAI	32	24
wordprocessing	11	3
programming	8	7
simulations	4	4
data base	5	3
produce class handouts	9	4
produce IEP's for LD students	3	0

Figure 5. Microcomputer use by application.

Another important issue was to determine whether the microcomputers were most often used in individual classrooms or in the lab settings, since both settings were available in all three schoools cbserved. The frequency of each setting by site during the observations is shown in Figure 6.

	setting:		
site:	*lab:*	*classroom:*	*total:*
Longfellow	8	8	16
Fairview	4	18	22
Crestwood	3	12	15
total	15	38	53

Figure 6. Frequency of participant observations by site and setting.

The amount of software and computer use at each site were also determined with the help of the computer. The computer usage figures were gathered from the weekly and monthly sign-out sheets and log books of the three librarians. The monthly numbers were entered into a simple spreadsheet using the MultiPlan© softwaare which tabulated the data into the three tables shown below that were used as an indication of the level of usage of the innovation.

Table A: Librarian records of software circulation.

School: Longfellow Middle School

Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May-Jun
1	7	15	6	2	4	2	8	28	31

Note: Does not include software that is in the computer lab, only software checked out of the library.

School: Crestwood Elementary School

Jan	Feb	Mar	Apr	May	Jun
62	127	171	178	138	27

Note: All software was checked out before use, since the computers were usually not used in a lab setting in this school, but in the individual classrooms. The librarian started keeping the software figures in January.

School: Fairview Elementary School

Aug-Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May-Jun
71	45	32	13*	21*	34	45	58	133

Note: Circulation of software for the three days per week when the computers circulate. The other two days per week the computers are in the lab with the software, and the software does not have to be checked out to be used. Figures include instructional use only **out** of the lab. They do not include management use on part of teachers to prepare materials, keep records

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Table B. Use of Middle School Computer Lab

Month:	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	total
Available Lab Periods:	123.5	149.5	117	97.5	110.5	110.5	130	130	136.5	32.5	**1137.5**
Lab Periods Used:											
Computer Literacy:	50	53	72	59	62	27	36		33	1	393
Word Processing:						9		16	14		39
Guidance:		24	13	13	7						57
Data Base:									2		2
Other:											
home ec:									14		14
music:									3	2	5
learning disabled:									2		2
science:						6			7		13
misc:			2	1							3
Total other:			2	1		6			26	2	37
Total Lab Use:	**50**	**77**	**87**	**73**	**69**	**42**	**36**	**16**	**75**	**3**	**528**

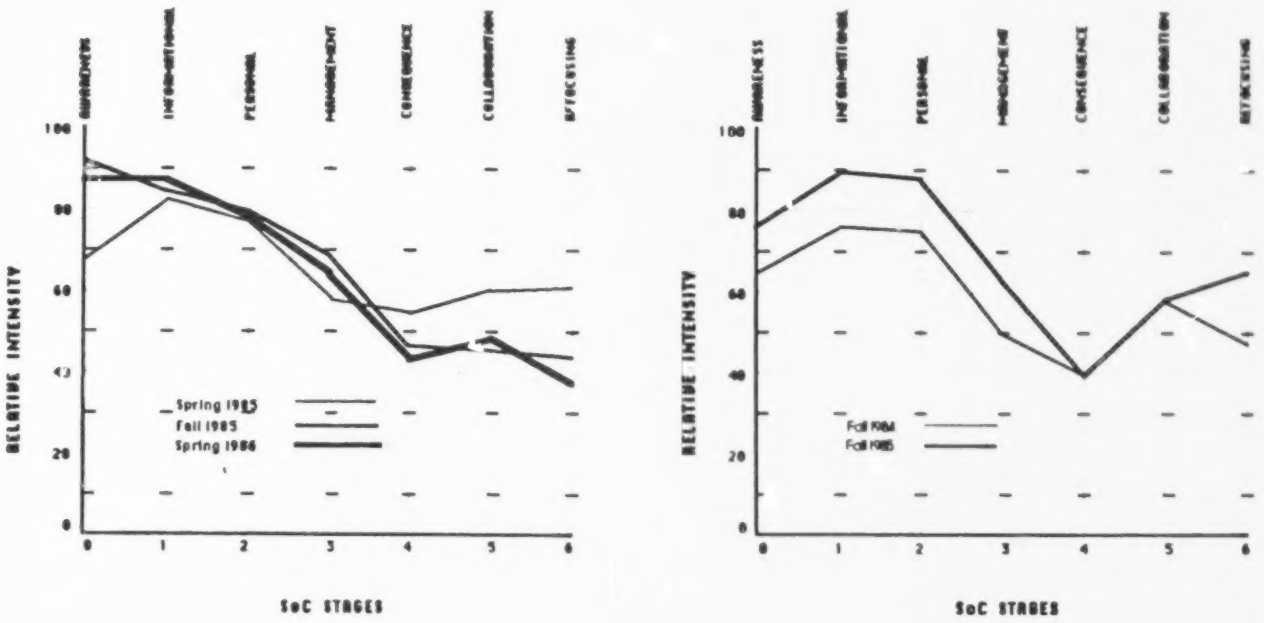
Table C. Use of Computers in Middle School Classrooms

month:

Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	total
6	39	84	129	30	39	165	108	93	70	12	775

(Measured in computer periods - 1 computer used 1 period)

The final way that the microcomputer was used as a reserach tool was in the production of the graphical information for the final report using the MacDraw© graphics package available on the Macintosh. For example, the data from the individual SoCQ's were aggregated into composite profiles and represented in the graphs shown in Figure 7. The relationship between three factors and the inplementation process is shown in the diagram in Figure 8. Both were drawn using MacDraw©.



Pretest Composite Profiles

Posttest Composite Profiles

Figure 7. Composite stages-of-concern data

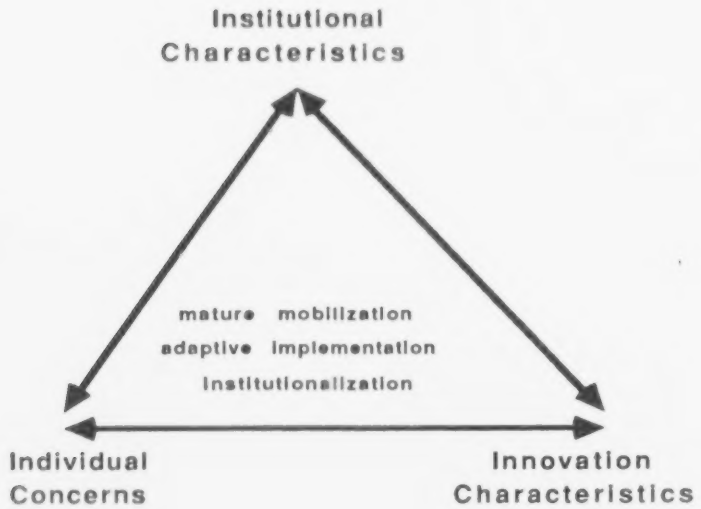


Figure 8. Context for implementation

New Computer Tools Available to Aid Qualitative Research

In the past year the release of HyperCard© and other software packages that implement the concept of hypertext have generated considerable excitement. Hypertext is information that has been arranged in such a way that there are relational links between common themes similar to the way the human mind works. With hypertext the user has the ability to jump from one body of text (or graphical information) to another based upon a common word or concept. In HyperCard©, which has been implemented on the Macintosh computer, data is arranged in "stacks" like filing cards. Each card in a stack is linked to the other cards in its own stack and can also be linked to cards in other stacks, as shown in Figure 9.

Thus, it is possible to organize large stacks of data, in which the individual elements are linked together with other elements in whatever logical order is desired by the user. This threaded text can then be accessed in many different orders, depending upon the interest at the time of use. The links can be altered at any time by the user of the stack of information, if new connections are desired. The representation of fieldnotes as hypertext would allow tremendous flexibility in accessing and analyzing the data.

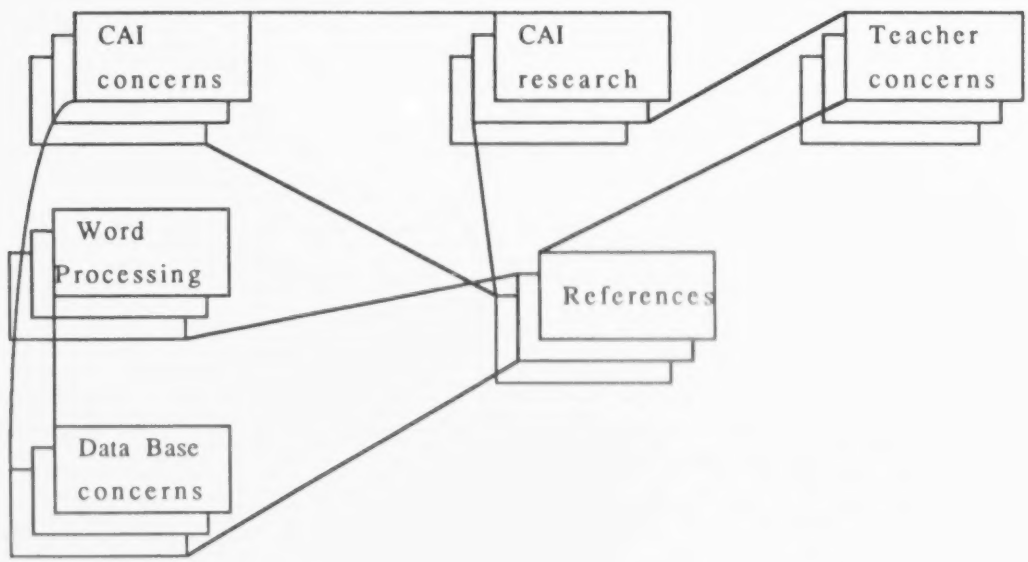


Figure 9. Example of Hypertext

Also of interest to qualitative researchers is the development of expert systems to do content analysis of qualitative data. Several expert systems are now available, but it is too soon to report on their effectiveness.

Conclusions

The use of the microcomputer to facilitate the qualitative research process in this study did not involve the use of any complicated or specialized software. It did not involve the use of statistical packages typical of quantitative research. It did not interfere in any way with the naturalistic setting of the research sites. Rather, standard software packages available with most personal microcomputers were used throughout the data collection, analysis, and reporting stages of the research to facilitate the whole research process. The ethnographic interviews and participant observations were typed into computer files from hand-written fieldnotes using the wordprocessing software. Each encounter was also coded into a computer data base using seven different fields for reference. Based upon analysis of content, the historical documents were similarly entered into a computer data base. A spreadsheet was

used to record and tabulate some statistical data. A file of references for the bibliography was established at the beginning of the project and continuously updated as the research proceeded.

As the research progressed, major themes were identified in the data and were easily tracked in the fieldnotes using the searching capabilities of the data base. When the data were analyzed, the computer data base was used to tabulate the frequency of observations and interviews conducted at each site, the frequency of observations and interviews conducted with each type of subject, and the frequency of occurrences of certain events, usages, or attitudes. It was also used to locate where those occurrences could be found in the data since each set of fieldnotes was coded with a number.

It was during the final phase of the research, the presentation of the results, that the use of the microcomputer proved to be most valuable. As the data was organized within the theoretical framework of the research, excerpts from the data were electronically copied from the files of the original fieldnotes and electronically pasted into the desired place in the research paper, which was being written with the same wordprocessing software used for the fieldnotes. The tabular data from the spreadsheet was electronically pasted into the desired place in the research paper. Using the graphics software, the appropriate illustrations were made and electronically pasted into the desired place in the research paper. Rearrangement of the text and any other editing was easily accomplished electronically.

The use of a microcomputer to handle the large volume of ethnographic data allowed the researcher to perform the data collection, analysis and presentation more efficiently. The availability of a number of standard software packages allowed the researcher to facilitate the entire research process without having to depend upon staff computer programmers for a special package. The user-friendly, icon-based computing environment of the Macintosh microcomputer tallowed the user to move easily between different software applications and made it particularly well-suited for social science research.

New software is now available that allows the user to record the fieldnotes and to link them together in a hypertext form that will facilitate analysis of the data even further. In the future expert systems will be developed that will provide content analysis of text data. As these new electronic analysis tools become available to the qualitative researcher, the burden of large volumes of data will be eased, allowing the researcher to focus on the phenomenon being studied rather than the mechanics of handling the data.

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